Advanced Science and Technology Letters
Vol.39 (Games and Graphics 2013), pp.14-19
http://dx.doi.org/10.14257/astl.2013.39.03

EEG Signal feature analysis of Smartphone Game User

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Abstract. The first brain wave study was started for a monkey to control an arm with a motor. Recently, studies are on the progress for raising children's attention or understand a patient situation by using the measured brain wave. In this paper, measure attention and meditation of EEG signal when play a game and compared the difference of EEG signal according to the game user. The reason of measure up the EEG signal during play a game is the analysis about existing game play made through a survey. This survey method depends on memory and expression of human so there are some hard problems to acquire an objective data. Therefore, for acquire engineered and objective data, measure EEG signal and analyze EEG feature to compare and analyze the game user state is the goal of this study.

Keywords: Game Play Test, Game User Feedback, EEG.

1 Introduction

Brian Computer Interface has been used in medical related field. BCI is used for prophylactic and therapeutic program for dementia patient or attention deficit hyperactivity disorder patient. [1] Recently, the price of BCI measuring device is low so the range to use is gradually expanded. For the first typical case, it uses for to know the state of patient in medical related field. [2] Second is training program to control the brain wave. The case is nuero feedback. [3] The third is the case of measure the brain wave and apply for control. [4] We apply EEG signal, compare and analyze the features on the changes of attention and meditation of EEG signal when play a game. Measuring EEG signal while play a game is because it has a difficult problem to obtain an objective data according to the existing game play analyze made with survey so it depends on the memories and expression of human. The compared and analyzed data's attention and meditation quantitative result is checked on the user state when a game plays. While on the state of attention playing a game was bored and tired state, on the opposite meditation state was checked as a pleasant state while play a game through the data. This paper is formed as follows. Chapter 2, EEG signal analyze and introduce the existing related study for measuring when a game play, chapter 3, propose EEG measurement composition of game user when a game play

ISSN: 2287-1233 ASTL

and explained about the result of EEG measurement, and the chapter 4 conclude the paper.

2 Related works

Related works introduces the existing study of EEG cognizance and EEG signal analysis.

2.1 EEG cognizance

EEG is the electronic flow when deliver the signal between nervous system and a cranial nerve. When measuring EEG, a very complicated form structure appears as [Fig. 1] This kind of data calls raw data and also unseparated of brain wave by each frequencies. [5] These raw data contains more static signal than extraction signal part so it has to filtering at preconditioning process. The preconditioning process use power spectrum method the most, conversion raw data to power spectrum form then it spears as [Fig. 2].

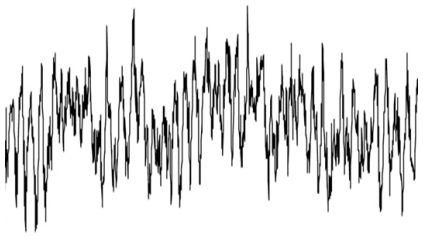

Fig.1. Row data of EEG

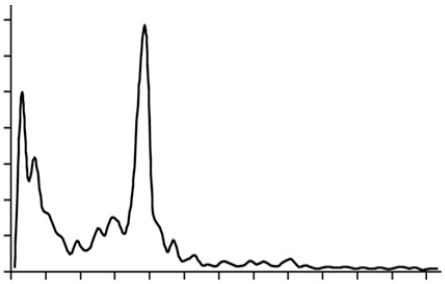

Fig.2. Change raw data to poser spectrum

2.2 EEG Signal alaysis

The power spectrum of Brain wave is categories by frequencies, different amplitude by each frequency. features of each frequency are classified as table.1.

Table 1. Types and feature of Brain wave

Type	Frequency (Hz)	Normally
Delta	0.5 – 4 Hz	hypnoidal
Theta	4 – 7 Hz	slow wave sleep
Alpha	8 -12 Hz	stable wave
Beta	12 -30 Hz	action wave
Gamma	Over 30 Hz	arousal and exciement

3 EEG measurement of game user when a game plays

In chapter 3 describes about EEG measurement process, explains about measurement target and hardware spec, also organized about acquired measurement result.

3.1 Measurement target and Hardware spec

The participation of the test is a 1 twenties male and female, 2 thirties male and female, total 6 people were participated and measured for usual game players. The chosen game for measuring EEG is the [Fig. 3] that is a service from NHN Entertainment. 'POKO PANG' is a smart phone game and the genre is casual puzzle game. The game rule is to connect the puzzle pieces to a line and explode to get a high score in 1 minute limited time.

Fig. 3. Smartphone game contents, POKOPANG

The measurement hardware is Brain Wave Interface developed by NeroSky from America. Attention and meditation is distributable by low price device. It is suitable for unprofessional or professional using dry active sensor. Mindset analyzes and checks brain wave in a real time using Neuro feedback system and there is a technology which helps to change according to the brain wave needs. [9]

Fig. 4. Mindset

3.2 EEG measurement process

During the game play the process for measuring EEG is as [Fig. 5] Game user and game world interact, while interaction the EEG device measure in a real time, express EEG signal on a computer, save process is progressed.

Fig. 5. EEG measurement process

3.2 EEG Signal measurement test and result during game play

EEG signal transformed process as [Fig. 6] Through FFT algorithm (Fast Fourier Transform) acquired brain wave through measuring device have value for each frequencies. Use the data by transform these to attention and meditation numerical value.

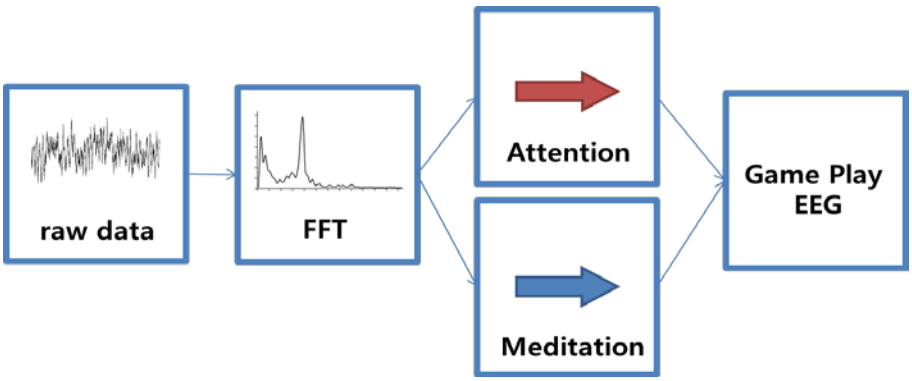

Fig. 6. Transformation process

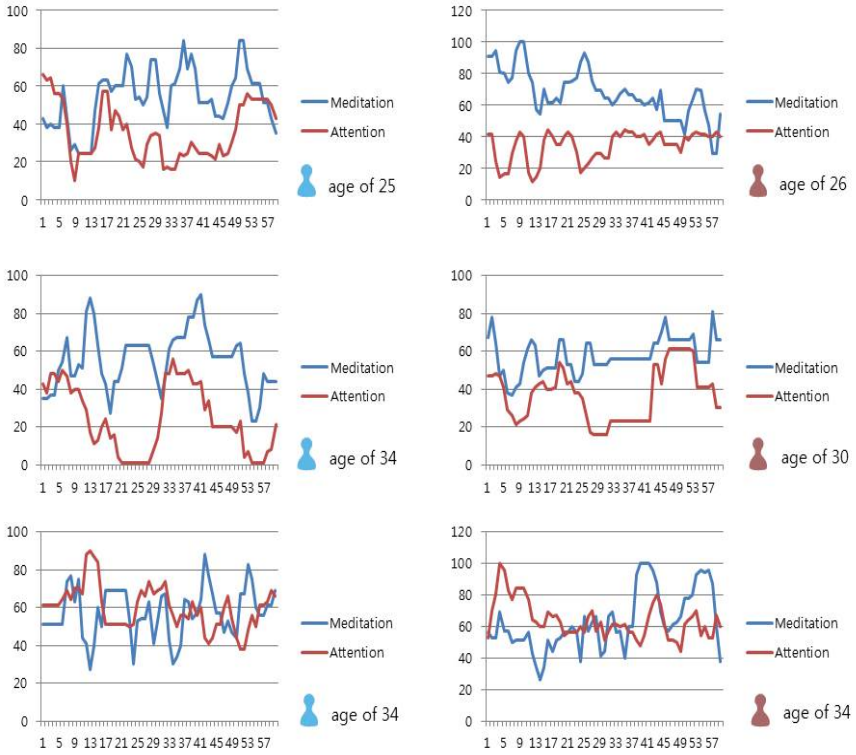

Fig. 7. EEG measurement transformation result game play

The graph according to each game user is like the [Fig. 7] Measurement result of meditation value is for all male and female game user checked that has a high value after 40 second. Also for the female user meditation average value is higher than the male user but the attention value is higher for male user so the female users have more interests.

4 Conclusion

We measured the EEG change state of the game user while on a game play. Compared and analyzed data based on measured EEG is able to confirm the quantitative result at the attention and meditation of the user state when play the game. While play the game the state were bored and tired at the attention state, but on the opposite at the meditation state the game players were comfortable and enjoyable were checked through EEG data. For the future study, find problem for measuring method while on a game play and will add a test of additional physiological signal to solve a problem widely.

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